**Nonenteric Enterics (Nonenteric bacteria families that infect the GI tract)**

Bacteria → GM- → Curved/Helical → Helicobactor

**Helicobactor pylori**

* Several polar flagella → highly motile → corkscrew motility
* Epidemiology
  + Transmission via fecal-oral and oral-oral route
  + Developing countries – 70-90% overall starting at 10 yrs
  + Developed countries – 45% overall but very low during childhood
* Pathophysiology Problems + Solutions
  + Hostile Environment
    - Production of urease (urea → NH3 + CO2) → ↑ pH in immediate vicinity
    - Expression of flagella → ↑ motility to reach mucin layer (acts as buffer against gastric cells)
  + Thick + Viscous Mucous
    - Expression of flagella → corkscrew motility allows passage thru mucous
    - Expression of mucinase + phospholipases → liquefies the mucous
  + Stomach contents flowing thru GI system
    - Expression of multiple adhesins → allows sticking to surface
  + Immune Defense
    - Catalase | Arginase | Superoxide dismutase → detoxify ROS
    - Pylori LPS not toxic + looks like “self”
    - Pylori flagellin is poorly recognized by TLR5
    - VacA inhibits T-cell proliferation + stop B-cell Ag presentation
  + Damage by H. pylori
    - Ammonia by urease → damages host
    - VacA → influx of cations → kills cells + loosens jxns b/w cells
    - NAP(neutrophil activation protein) → activates immune cells → ↑ROI
    - CagA → phosphorylates host proteins → chronic inflammation
* Oncogenesis
  + Colonization → Chronic superficial gastritis
    - → Peptic Ulcer Disease
    - → Lyphoproliferative Disease → B-cell MALT lymphoma (5%)
    - → Chronic Atrophic Gastritis → Gastric Adenocarcinoma
      * CagA enters host, gets Tyr phosphorylated, induces ↑ cell migration
* Diagnosis
  + Silver strain – small curved rods as epithelial cells
  + Urease | Serologic | PCR | Culture → 3 days under reduced O2, ↑CO2 @ 37° C
* Treatment – Only treat if causing ulcers
  + Tetracycline | Clarithromycin | Amoxicillin | Metonizadole | With PPI – 80% effective

Bacteria → GM- → Curved/Helical → Campylobactor

**Campylobacter jejuni** (#1 cause of bacterial gastroenteritis in US)

* Gm- | Spiral shape
* Epidemiology
  + Incubation: 2-5 days
  + Transmission: Via contaminated food, milk, water
* Clinical Symptoms
  + Fever | Abdominal Pain | Diarrhea (often bloody) → Self-Limiting
* Pathophysiology
  + Damages mucosal surface → ulcerated + bloody surface → cryptic abscesses in epithelial glands
* Virulence Factor
  + Cytolethal distending toxin (CDT)
    - Delivers DNAse blocking mitosis + triggering apoptosis
  + Capsule: Immune evasion | Invasion factors | Adhesins | Flagellum | LOS
* Guillain-Barre Syndrome (GBS)
  + Paralysis for several weeks due to demyelination of nerves (autoimmune syndrome)
  + Patho: LOS has a group that is identical to myelin gangliosides, so formation of Ab against bacteria ends up turning against myelin regeneration
  + T: Respirator | Plasma Exchange | Corticosteroids
* D: ELISA | Culture: 2-3 days at ↓O2 + ↑CO2 @ 42° C
* T: Rehydration/Electrolytes | Macrolides (if necessary)

Bacteria → GM- → Curved/Helical → Vibrio

**Vibrio cholerae**

* Gm- | Comma-shaped | Single polar flagellum | Facultative anaerobe
* Epidemiology
  + Incubation: 2-4 days
  + Ctx+ - Severe symptoms | Ctx- - Milder symptoms
* Clinical Symptoms
  + Abrupt watery diarrhea “Rice Water” | Metabolic acidosis | Hypokalemia → Cardiac arrythmias| Hypovolemic shock
  + Mortality – 60% if untreated
  + Survivors have immunity
* Pathophysiology

1. Ingestion – Crucial because bacteria is acid-sensitive
2. Flagellum allows rapid movement through stomach
3. Adheres + Colonizes SI
4. Produces toxins
5. Extensive fluid/ion loss

* Virulence Factors
  + Cholera toxin expressed by O1 and O139 serotypes
    - A-B toxin | A – ADP-ribosylates Gs protein to “ON” position → ↑cAMP
      * Leads to hypersecretion of H2O + electrolytes
    - Results in 20L of H2O lost per day
  + Neuroamindase – modifies host cell receptor to ↑ Cholera Toxin binding
* Treatment
  + Rehydration + Electrolytes ASAP
  + Doxycycline/Azithromycin to shorten course + reduce spread, but NOT required

**V. parahaemolyticus (**#1 cause of seafood-associated gastroenteritis)

* Clinical Symptoms
  + Explosive onset of watery diarrhea
  + N/V | cramps | H/A | Low fever
  + Self-limiting in 3 days
* Virulence Factor: Kanagawa toxin - ↑ Cl- secretion + tissue damage
* T: Rehydration

**V. vulnificus (**#1 cause of seafood-related US deaths)

* Clinical Symptoms
  + Diarrhea | N/V | Abd cramps → Esp. in immunocompromised people
  + Necrotizing fasciitis if enters wound
* T: Minocycline/Doxycycline + FQ/cefotaxime